REPORT No.: SZ19070448W04

TEST REPORT

APPLICANT	:	Shenzhen Jaguar Wave Technology LTD
PRODUCT NAME	:	Wireless Gigabit Mobile Hotspot
MODEL NAME	:	JW-MRD-6001
BRAND NAME	:	JAGUAR WAVE
FCC ID	:	2ARPAJW-MRD-6001
STANDARD(S)	:	47 CFR Part 15 Subpart E
RECEIPT DATE	:	2019-08-02
TEST DATE	:	2019-08-09 to 2019-09-02
ISSUE DATE	:	2019-09-03

Edited by: Zeng Xiaoying (Rapporteur)

Approved by: Peng Huarui (Supervisor)

MORLAB

SHENZHEN MORLAB COMMUNICATIONS TECHNOLOGY Co., Ltd.
FL1-3, Building A, FeiYang Science Park, No.8 LongChang Road,
Block67, BaoAn District, ShenZhen , GuangDong Province, P. R. China

Tel: 86-755-36698555 Fax: 86-755-36698525
Http://www.morlab.cn E-mail: service@morlab.cn

DIRECTORY

Change History		
Version	**Date**	**Reason for change**
1.0	2019-09-03	First edition

1. Technical Information

Note: Provide by applicant.

1.1. Applicant and Manufacturer Information

Applicant:	Shenzhen Jaguar Wave Technology LTD
Applicant Address:	Unit 1002/1003, Block 2A, Tongtai Times Center, No.6259 Baoan Road, Fuhai Street, Baoan District, Shenzhen City, P.R.China
Manufacturer:	Shenzhen Jaguar Wave Technology LTD
Manufacturer Address:	Unit 1002/1003, Block 2A, Tongtai Times Center, No.6259 Baoan Road, Fuhai Street, Baoan District, Shenzhen City, P.R.China

1.2. Equipment Under Test (EUT) Description

Product Name:	Wireless Gigabit Mobile Hotspot	
Serial No:	(N/A, marked #1 by test site)	
Hardware Version:	P1	
Software Version:	1.0.201810120116	
Modulation Type:	OFDM	
Modulation Mode:	802.11a, 802.11n(HT20), 802.11n(HT40) 802.11ac(VHT20), 802.11ac(VHT40)	
Operating Frequency Range:	5.180 GHz- 5.240 GHz; 5.745GHz- 5.825GHz	
Channel Number:	Refer to 1.3	
Antenna Type:	PIFA Antenna	
Antenna Gain:	Ant 0: -2.0 dBi; Ant 1: -2.0 dBi	
Directional Gain:	1.01 dBi Note 3	
Accessory Information:	Battery	
	Brand Name:	N/A
	Model No.:	JW-MRD-6001
	Serial No.:	(N/A, marked #1 by test site)
	Capacity:	4000mAh
	Rated Voltage:	3.85V
	Charge Limit:	4.40V

Accessory Information:	AC Adapter	
	Brand Name:	N/A
	Model No.:	TN-090200U1
	Serial No.:	(N/A, marked #1 by test site)
	Rated Output:	5V⎓3A or 9V⎓2A or 12V⎓1.5A
	Rated Input:	100-240V ～ 50/60Hz 0.5A

Note 1: WIFI hotspot does not support U-NII band.

Note 2: The EUT has two antennas and supports a MIMO function. Physically, the EUT provides two completed transmitters and two receivers for 802.11n and 802.11ac modulation mode.

Modulation Mode:	**TX Function**
802.11a	1TX
802.11n	2TX
802.11ac	2TX

Note 3: According to KDB 662911 D01, the directional gain = G_{ANT} + 10log(N_{ANT}) dBi, where G_{ANT} is the maximum antenna gain in dBi, N_{ANT} is the number of outputs.

Note 4: During test, the duty cycle of the EUT was setting to 100%.

Note 5: For conducted test item Maximum conducted output Power and Peak Power spectral density of each modulation mode, we recorded the test result of two antennas separately, for other conducted test items both of the two antennas were tested separately, we only recorded the worst test result(Ant 1) in this report.

Note 6: All radiation test items for 802.11n modulation mode operate at MIMO mode during the test. Other modulation mode operate at SISO mode, both of the two antennas were tested separately, we only recorded the worst test result(ANT1) in this report.

Note 7: For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacturer.

1.3. The channel number and frequency of EUT

Frequency Range: 5180MHz-5240MHz				
Bandwidth	Channel	Frequency (MHz)	Channel	Frequency (MHz)
20MHz	**36**	**5180**	40	5200
	44	**5220**	**48**	**5240**
40MHz	**38**	**5190**	**46**	**5230**
Frequency Range: 5745-5825MHz				
Bandwidth	Channel	Frequency (MHz)	Channel	Frequency (MHz)
20MHz	**149**	**5745**	153	5765
	157	**5785**	161	5805
	165	**5825**		
40MHz	**151**	**5775**	**159**	**5795**

Note 1: The black bold channels were selected for test.

1.4. Test Standards and Results

The objective of the report is to perform testing according to 47 CFR Part 15 Subpart E (U-NII band) for the EUT FCC ID Certification:

No	Identity	Document Title
1	47 CFR Part 15 (5-1-14 Edition)	Radio Frequency Devices

Test detailed items/section required by FCC rules and results are as below:

No.	Section	Description	Test Date	Test Engineer	Result	Method determination /Remark
1	15.203	Antenna Requirement	N/A	N/A	PASS	No deviation
2	ANSI C63.10	Duty Cycle of the test signal	Aug 09, 2019	Zhou Chuang	PASS	No deviation
3	15.407(a)	Maximum conducted output Power	Aug 21, 2019	Zhou Chuang	PASS	No deviation
4	15.407(a) (e)	Emission Bandwidth	Aug 09, 2019	Zhou Chuang	PASS	No deviation
5	15.407(a)	Maximum Power spectral density	Aug 14, 2019	Zhou Chuang	PASS	No deviation
6	15.407(g)	Frequency Stability	Aug 21, 2019	Zhou Chuang	PASS	No deviation
7	15.207	Conducted Emission	Sep 01, 2019	Peng Xuewei	PASS	No deviation
8	15.407(b)	Restricted Frequency Bands	Aug 17, 2019	Peng Xuewei	PASS	No deviation
9	15.407(b)	Radiated Emission	Aug 21, 2019	Peng Xuewei	PASS	No deviation

Note1: The tests of Conducted Emission and Radiated Emission were performed according to the method of measurements prescribed in ANSI C63.10 2013.

Note2: These RF tests were performed according to the method of measurements prescribed in KDB789033 D02 General UNII Test Procedures New Rules v02r01, KDB662911 D01 Multiple Transmitter Output v02r01.

Note3: The path loss during the RF test is calibrated to correct the results by the offset setting

in the test equipments. The ref offset 12.5dB contains two parts that cable loss 2.5dB and Attenuator 10dB.

Note 3: Additions to, deviation, or exclusions from the method should be judged in the "method determination" column of add, deviate or exclude from the specific method should be explained in the "Remark" of the above table.

1.5. Environmental Conditions

During the measurement, the environmental conditions were within the listed ranges:

Temperature (°C):	15 - 35
Relative Humidity (%):	30 -60
Atmospheric Pressure (kPa):	86-106

2. 47 CFR Part 15E Requirements

2.1. Antenna requirement

2.1.1. Applicable Standard

According to FCC 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

2.1.2. 2.1.2 Result: Compliant

The EUT has a permanently and irreplaceable attached antenna. Please refer to the EUT internal photos.

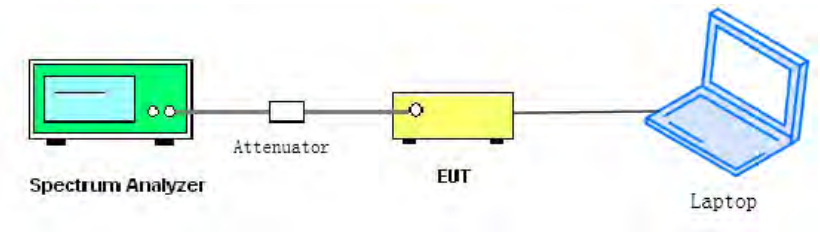
2.2. Duty Cycle of the test signal

2.2.1. Requirement

Preferably, all measurements of maximum conducted (average) output power will be performed with the EUT transmitting continuously (i.e., with a duty cycle of greater than or equal to 98%). When continuous operation cannot be realized, then the use of sweep triggering/signal gating techniques can be used to ensure that measurements are made only during transmissions at the maximum power control level. Such sweep triggering/signal gating techniques will require knowledge of the minimum transmission duration (T) over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation. Sweep triggering/signal gating techniques can then be used if the measurement/sweep time of the analyzer can be set such that it does not exceed T at any time that data are being acquired (i.e., no transmitter OFF-time is to be considered).
When continuous transmission cannot be achieved and sweep triggering/signal gating cannot be implemented, alternative procedures are provided that can be used to measure the average power; however, they will require an additional measurement of the transmitter duty cycle (D). Within this subclause, the duty cycle refers to the fraction of time over which the transmitter is ON and is transmitting at its maximum power control level. The duty cycle is considered to be constant if variations are less than ±2%; otherwise, the duty cycle is considered to be nonconstant.

2.2.2. Test Description

A. Test Set:



The EUT is coupled to the Spectrum Analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading.

B. Test Procedure

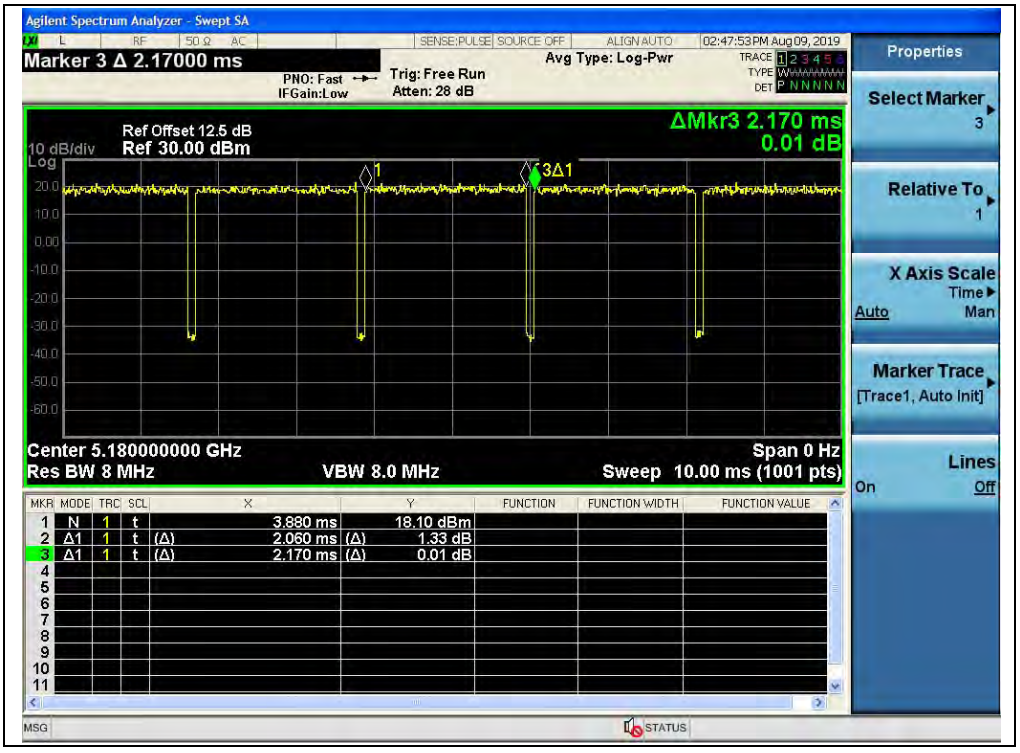
KDB 789033 Section B was used in order to prove compliance.

2.2.3. Test Result

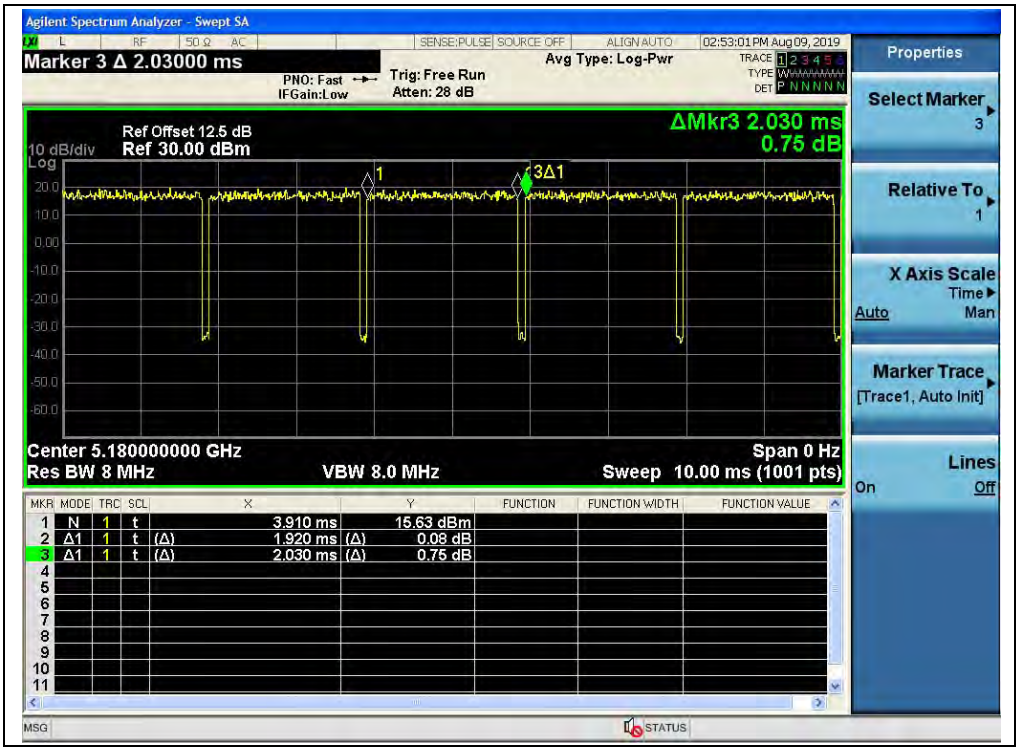
A. Test Verdict:

Test Mode	Duty Cycle (%) (D)	Duty Factor (10*log[1/D])
802.11a	94.93	0.23
802.11n(HT20)	94.58	0.24
802.11n(HT40)	90.05	0.46
802.11ac(VHT20)	95.07	0.22
802.11ac(VHT40)	90.05	0.46

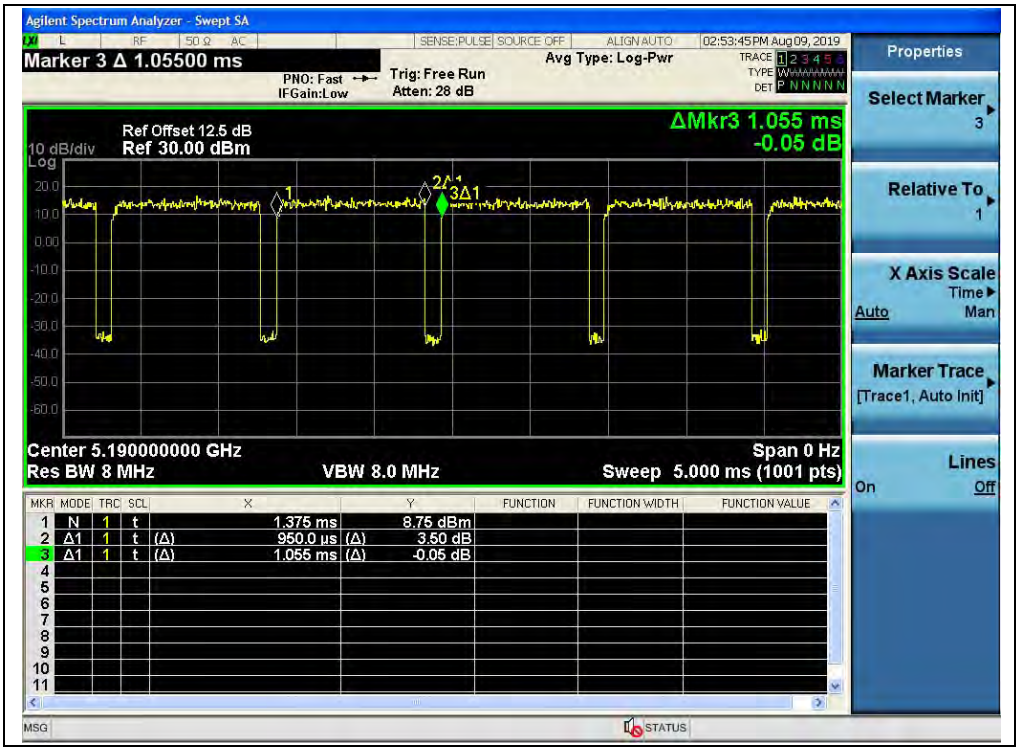
B. Test Plots



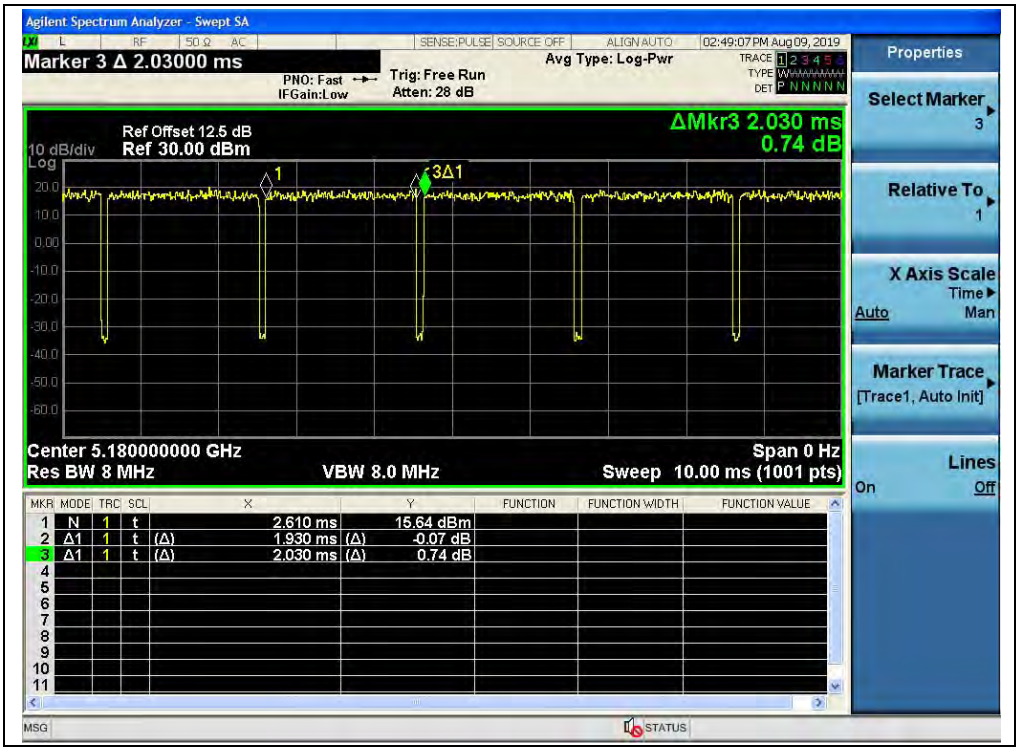
(CH36_5180MHz_802.11a)



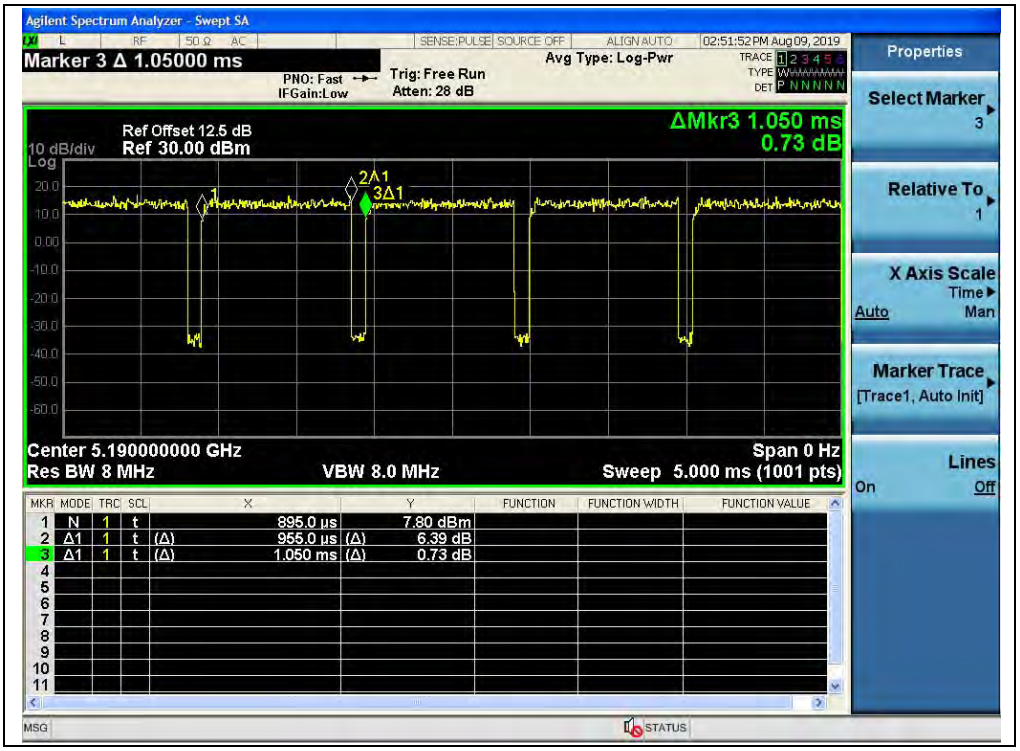
(CH36_5180MHz _802.11n(HT20))



(CH38_5190MHz _802.11n(HT40))



(CH36_5180MHz _802.11ac(VHT20))



(CH38_5190MHz _802.11 ac(VHT40))

2.3. Maximum conducted output power

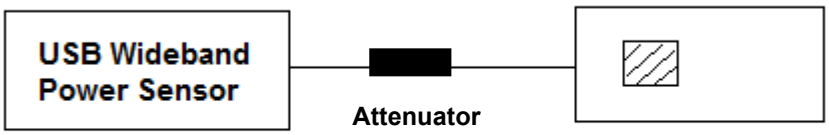
2.3.1. Requirement

(1) For client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi.
(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz.
(3) For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.
If transmitting antennas of directional gain greater than 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
(4) According to KDB662911D01Measure-and-sum technique, the conducted emission level (e.g., transmit power or power in specified bandwidth) is measured at each antenna port. The measured results at the various antenna ports are then summed mathematically to determine the total emission level from the device. Summing is performed in units that are directly proportional to power.
(5) According to KDB 662911 D01, the directional gain = G_{ANT} +10log(N_{ANT}) dBi, where G_{ANT} is the antenna gain in dBi, N_{ANT} is the number of outputs.

2.3.2. Test Description

Section E) 3) of KDB 789033 defines a methodology using a USB Wideband Power Sensor.

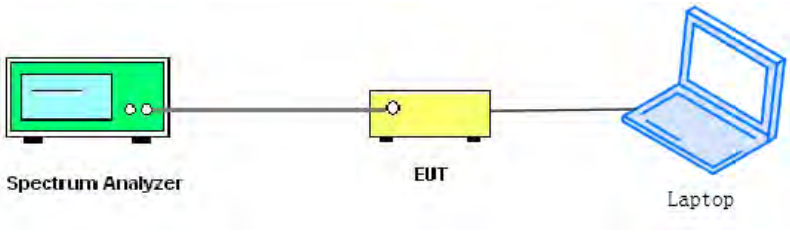
A. Test Setup:



(Test Module)

The EUT (Equipment under the test) which is coupled to the USB Wideband Power Sensor; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading, all test result in USB Wideband Power Sensor.

For ac (VHT80) mode power



The EUT (Equipment under the test) is coupled to the Spectrum analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading, all test result in Spectrum analyzer.

2.3.3. Test Result

Maximum Peak Conducted Output Power

802.11a Test mode

Channel	Frequency (MHz)	Measured Peak Power				Limit (dBm)		Verdict
		ANT 0		ANT 1				
		dBm	W	dBm	W	dBm	W	
36	5180	18.02	0.063	17.32	0.054	24	0.25	PASS
44	5220	18.15	0.065	17.37	0.055			
48	5240	**18.18**	**0.066**	17.69	0.059			
149	5745	17.21	0.053	**21.34**	**0.136**	30	1	
157	5785	17.35	0.054	21.11	0.129			
165	5825	17.38	0.055	16.53	0.045			

802.11n (HT20) Test mode

Channel	Frequency (MHz)	Measured Peak Power		Total Power		Limit (dBm)		Verdict
		ANT 0	ANT 1					
		dBm	dBm	W	dBm	dBm	W	
36	5180	19.31	18.80	0.161	22.07	24	0.25	PASS
44	5220	19.07	18.83	0.157	21.96			
48	5240	19.22	18.95	0.162	22.10			
149	5745	18.74	22.33	**0.245**	**23.91**	30	1	
157	5785	18.49	22.08	0.232	23.66			
165	5825	18.41	17.55	0.126	21.01			
Note: Directional gain = -2.0dBi +10log(2) = 1.01dBi＜6dBi, so the power limit shall be 24dBm for 5.18-5.24 GHz band and 30dBm for 5.745-5.825 GHz band.								

802.11n (HT40) Test mode

Channel	Frequency (MHz)	Measured Peak Power		Total Power		Limit (dBm)		Verdict
		ANT 0	ANT 1					
		dBm	dBm	W	dBm	dBm	W	
38	5190	19.72	19.65	0.186	22.70	24	0.25	PASS
46	5230	19.85	19.57	0.187	22.72			
151	5755	19.40	22.43	**0.262**	**24.18**	30	1	
159	5795	19.29	18.38	0.154	21.87			
Note: Directional gain = -2.0dBi +10log(2) = 1.01dBi＜6dBi, so the power limit shall be 24dBm for 5.18-5.24 GHz band and 30dBm for 5.745-5.825 GHz band.								

802.11ac (VHT20) Test mode

Channel	Frequency (MHz)	Measured Peak Power		Total Power		Limit (dBm)		Verdict
		ANT 0	ANT 1					
		dBm	dBm	W	dBm	dBm	W	
36	5180	18.17	17.89	0.127	21.04	24	0.25	PASS
44	5220	18.14	17.93	0.127	21.05			
48	5240	18.35	17.98	0.131	21.18			
149	5745	17.62	21.65	**0.204**	**23.10**	30	1	
157	5785	17.54	21.41	0.195	22.90			
165	5825	17.40	16.56	0.100	20.01			
Note: Directional gain = -2.0dBi +10log(2) = 1.01dBi＜6dBi, so the power limit shall be 24dBm for 5.18-5.24 GHz band and 30dBm for 5.745-5.825 GHz band.								

802.11ac (VHT40) Test mode

Channel	Frequency (MHz)	Measured Peak Power		Total Power		Limit (dBm)		Verdict
		ANT 0	ANT 1					
		dBm	dBm	W	dBm	dBm	W	
38	5190	18.96	19.65	0.171	22.33	24	0.25	PASS
46	5230	19.03	19.57	0.171	22.32			
151	5755	18.42	22.01	**0.228**	**23.59**	30	1	
159	5795	18.46	17.28	0.124	20.92			
Note: Directional gain = -2.0dBi +10log(2) = 1.01dBi＜6dBi, so the power limit shall be 24dBm for 5.18-5.24 GHz band and 30dBm for 5.745-5.825 GHz band.								

Maximum Average Conducted Output Power

802.11a Test mode

Frequency (MHz)	Average Power							Limit		Verdict
	Measured		Duty Factor	Duty factor Calculated						
	ANT0	ANT1		ANT0		ANT1				
	dBm	dBm		dBm	W	dBm	W	dBm	W	
5180	11.48	10.99	0.23	11.71	0.015	11.22	0.013	24	0.25	PASS
5220	11.39	10.93		11.62	0.015	11.16	0.013			PASS
5240	11.58	11.10		**11.81**	**0.015**	11.33	0.014			PASS
5745	10.97	15.14		11.20	0.013	**15.37**	**0.034**	30	1	PASS
5785	10.89	15.02		11.12	0.013	15.25	0.033			PASS
5825	10.95	9.88		11.18	0.013	10.11	0.010			PASS

802.11n (HT20) Test mode

Frequency (MHz)	Average Power					Limit		Verdict
	Measured		Duty Factor	Total Power with Duty Factor				
	ANT0	ANT1						
	dBm	dBm		W	dBm	dBm	W	
5180	12.29	12.08	0.24	0.033	15.23	24	0.25	PASS
5220	12.15	11.83		0.032	15.04			PASS
5240	12.28	11.86		0.032	15.12			PASS
5745	11.64	15.97		**0.054**	**17.35**	30	1	PASS
5785	11.53	15.83		0.053	17.22			PASS
5825	11.57	10.63		0.026	14.18			PASS
Note: Directional gain = -2.0dBi +10log(2) = 1.01dBi＜6dBi, so the power limit shall be 24dBm for 5.18-5.24 GHz band and 30dBm for 5.745-5.825 GHz band.								

802.11n (HT40) Test mode

Frequency (MHz)	Average Power					Limit		Verdict
	Measured		Duty Factor	Total Power with Duty Factor				
	ANT0	ANT1						
	dBm	dBm		W	dBm	dBm	W	
5190	12.42	12.25	0.46	0.035	15.40	24	0.25	PASS
5230	12.49	12.26		0.035	15.44			PASS
5755	11.94	16.28		**0.059**	**17.68**	30	1	PASS
5795	11.87	10.87		0.028	14.48			PASS
Note: Directional gain = -2.0dBi +10log(2) = 1.01dBi＜6dBi, so the power limit shall be 24dBm for 5.18-5.24 GHz band and 30dBm for 5.745-5.825 GHz band.								

802.11ac (VHT20) Test mode

Frequency (MHz)	Average Power					Limit		Verdict
	Measured		Duty Factor	Total Power with Duty Factor				
	ANT0	ANT1						
	dBm	dBm		W	dBm	dBm	W	
5180	11.07	10.96	0.22	0.025	14.06	24	0.25	PASS
5220	11.03	10.81		0.025	13.97			PASS
5240	11.16	10.93		0.026	14.09			PASS
5745	10.61	15.01		**0.043**	**16.38**	30	1	PASS
5785	10.56	14.82		0.042	16.23			PASS
5825	10.56	9.57		0.021	13.15			PASS
Note: Directional gain = -2.0dBi +10log(2) = 1.01dBi＜6dBi, so the power limit shall be 24dBm for 5.18-5.24 GHz band and 30dBm for 5.745-5.825 GHz band.								

802.11ac (VHT40) Test mode

Frequency (MHz)	Average Power					Limit		Verdict
	Measured		Duty Factor	Total Power with Duty Factor				
	ANT0	ANT1						
	dBm	dBm		W	dBm	dBm	W	
5190	11.45	11.19	0.46	0.028	14.40	24	0.25	PASS
5230	11.60	11.25		0.028	14.51			PASS
5755	10.99	15.26		**0.047**	**16.68**	30	1	PASS
5795	11.01	9.87		0.023	13.58			PASS
Note: Directional gain = -2.0dBi +10log(2) = 1.01dBi＜6dBi, so the power limit shall be 24dBm for 5.18-5.24 GHz band and 30dBm for 5.745-5.825 GHz band.								

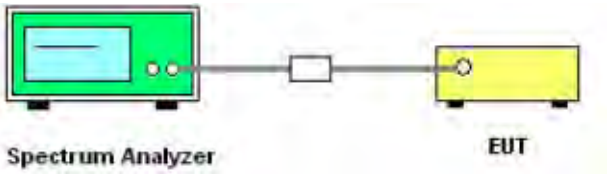
2.4. Emission Bandwidth

2.4.1. Requirement

For purposes of this subpart the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Determination of the emissions bandwidth is based on the use of measurement instrumentation employing a peak detector function with an instrument resolution bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement. Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

2.4.2. Test Description

A. Test Set:



The EUT is coupled to the Spectrum Analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading.

B. Test Procedure

1. KDB 789033 Section C) 1) Emission Bandwidth was used in order to prove compliance

a) Set RBW = approximately 1% of the emission bandwidth.

b) Set the VBW > RBW.

c) Detector = Peak.

d) Trace mode = max hold.

e) Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

2. KDB 789033 Section C) 2) minimum emission bandwidth for the band 5.725-5.85GHz was used in order to prove compliance.

Section 15.407(e) specifies the minimum 6 dB emission bandwidth of at least 500 KHz for the band 5.715-5.85 GHz. The following procedure shall be used for measuring this bandwidth:

a) Set RBW = 100 kHz.

b) Set the video bandwidth (VBW) ≥ 3 × RBW.

c) Detector = Peak.

d) Trace mode = max hold.

e) Sweep = auto couple.

f) Allow the trace to stabilize.

g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

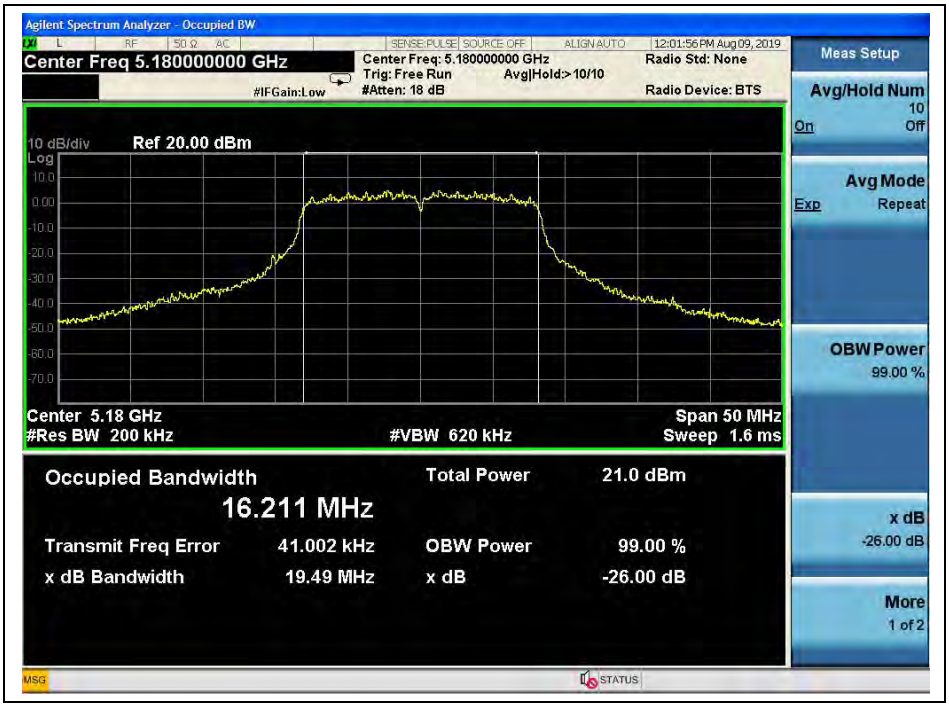
2.4.3. Test Result

802.11a Test mode

A. Test Verdict:

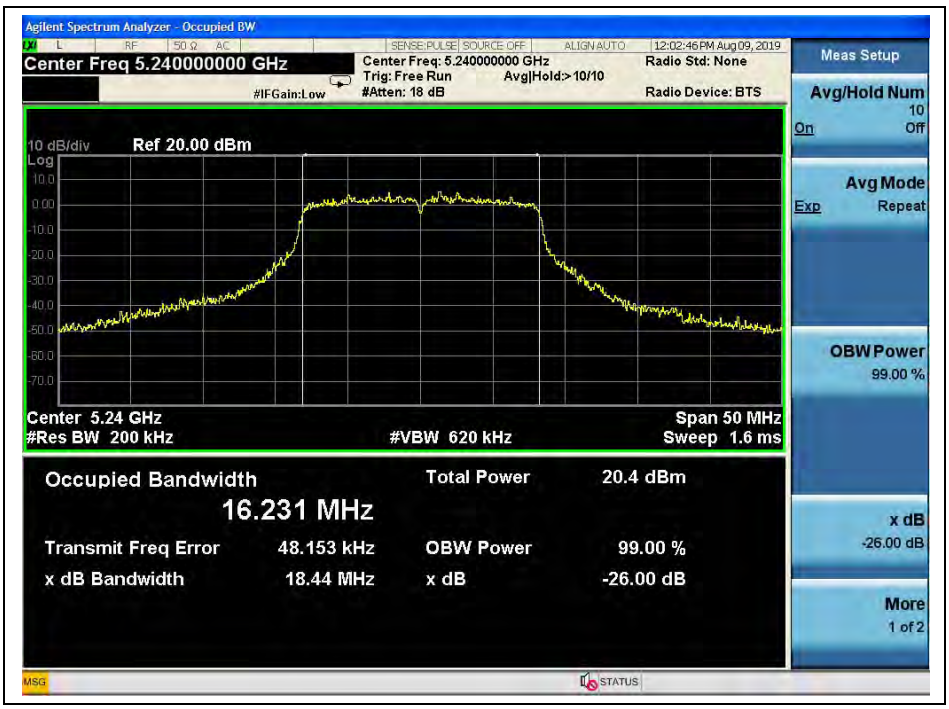
Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
36	5180	19.49
44	5220	18.72
48	5240	18.44
Channel	**Frequency (MHz)**	**6dB Bandwidth (MHz)**
149	5745	15.14
157	5785	14.60
165	5825	15.36

B. Test Plots

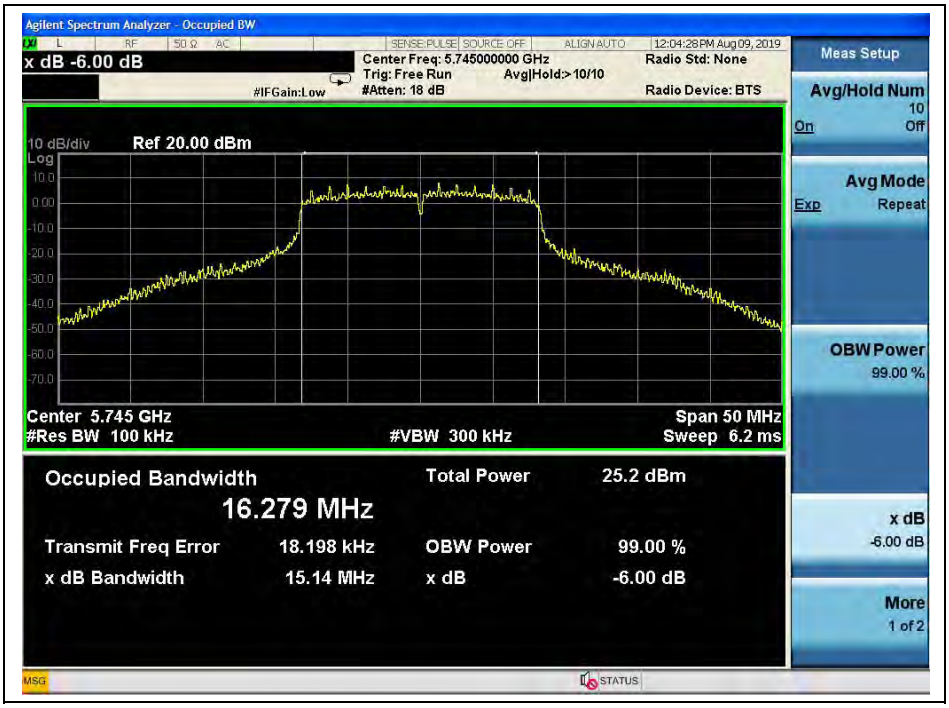


(Channel 36, 5180MHz, 802.11a,)

(Channel 44, 5220 MHz, 802.11a,)



(Channel 48, 5240MHz, 802.11a,)



(Channel 149, 5745MHz, 802.11a)

(Channel 157, 5785MHz, 802.11a)

(Channel 165, 5825MHz, 802.11a)

802.11n (HT20) Test mode

A. Test Verdict:

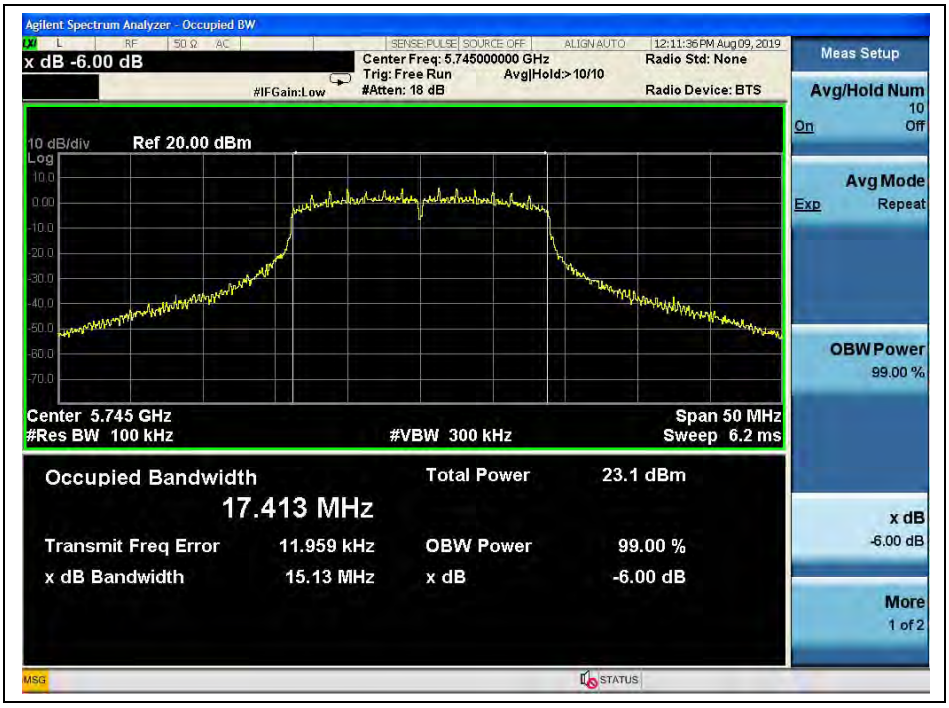
Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
36	5180	19.49
44	5220	18.72
48	5240	18.44
Channel	**Frequency (MHz)**	**6dB Bandwidth (MHz)**
149	5745	15.14
157	5785	14.60
165	5825	15.36

B. Test Plots

(Channel 36, 5180MHz, 802.11 n (HT20))

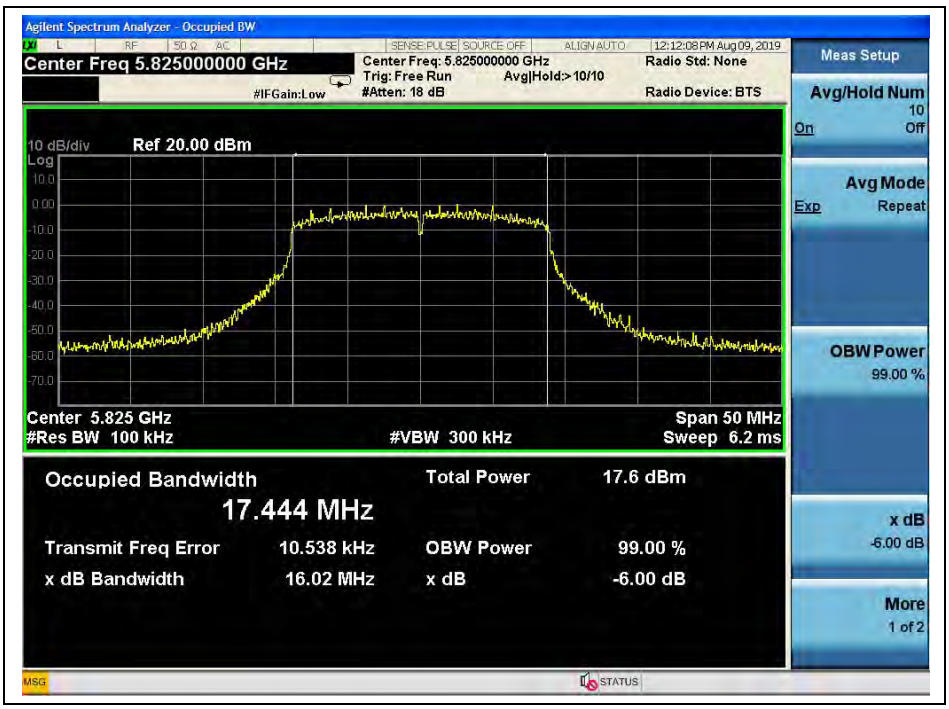
(Channel 44, 5220 MHz, 802.11 n (HT20))

(Channel 48, 5240MHz, 802.11 n (HT20))



(Channel 149, 5745MHz, 802.11 n (HT20))

(Channel 157, 5785MHz, 802.11 n (HT20))



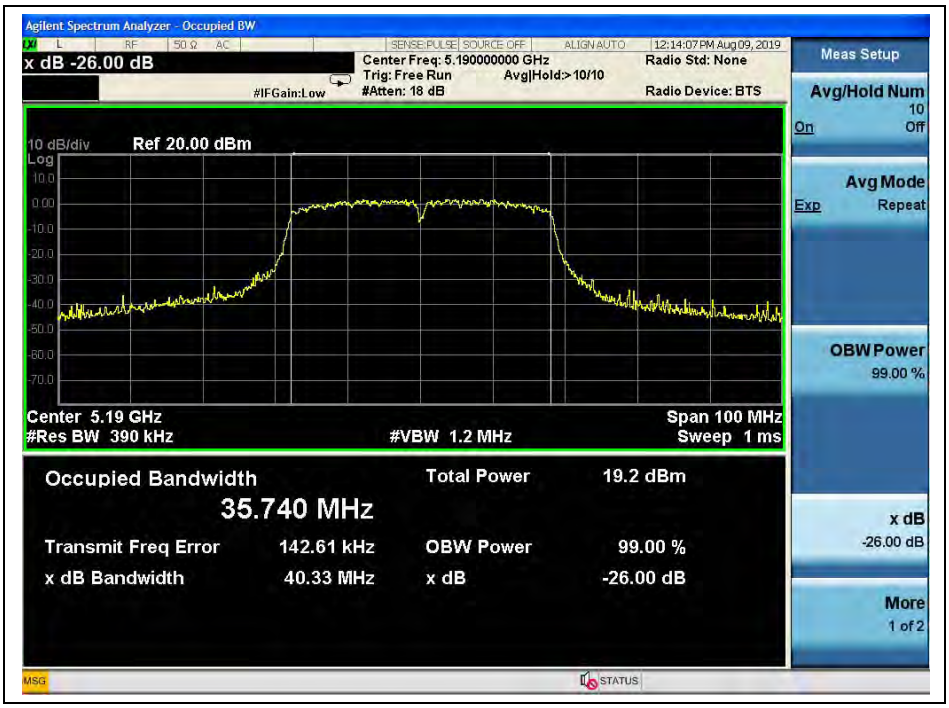
(Channel 165, 5825MHz, 802.11 n (HT20))

802.11n (HT40) Test mode

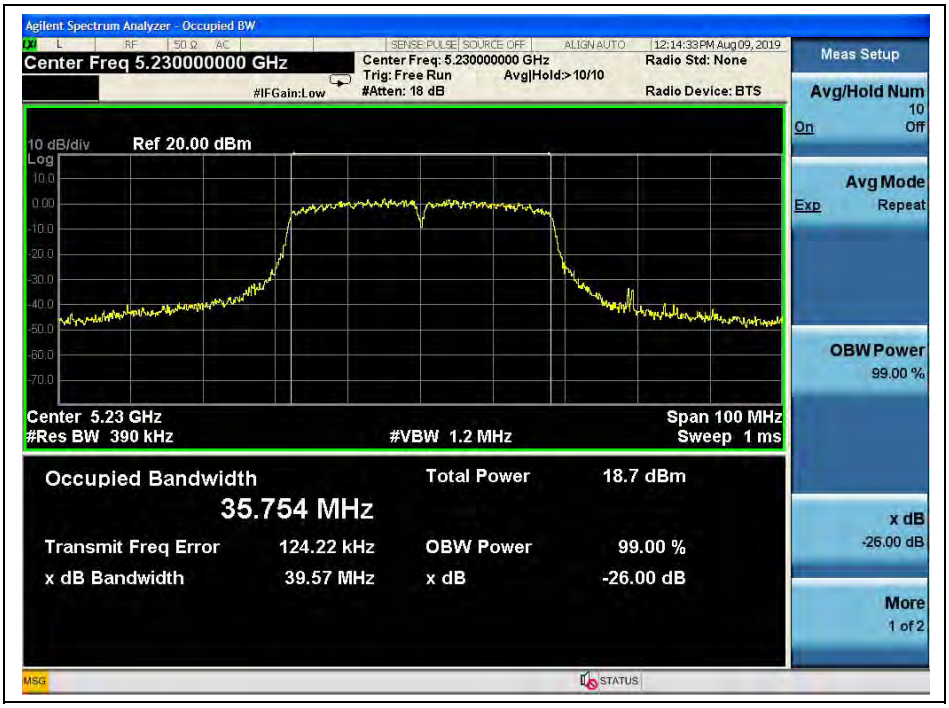
A. Test Verdict:

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
38	5190	40.33
46	5230	39.57
Channel	**Frequency (MHz)**	**6dB Bandwidth (MHz)**
151	5755	33.24
159	5795	34.48

B. Test Plots

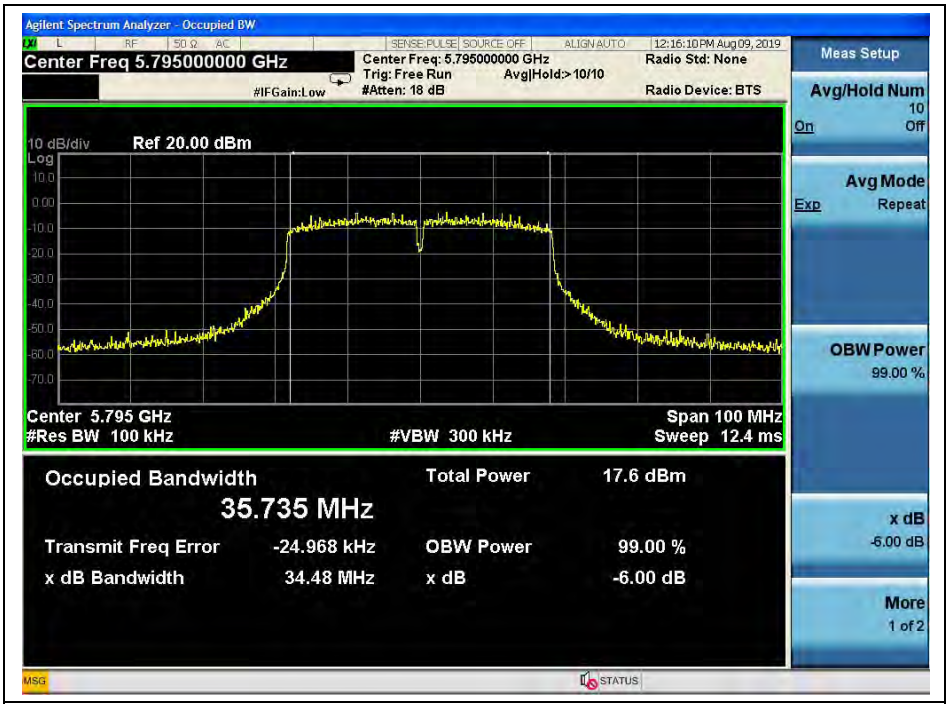


(Channel 38, 5190MHz, 802.11n (HT40))



(Channel 46, 5230 MHz, 802.11n (HT40))

(Channel 151, 5755 MHz, 802.11n (HT40))



(Channel 159, 5795MHz, 802.11n (HT40))

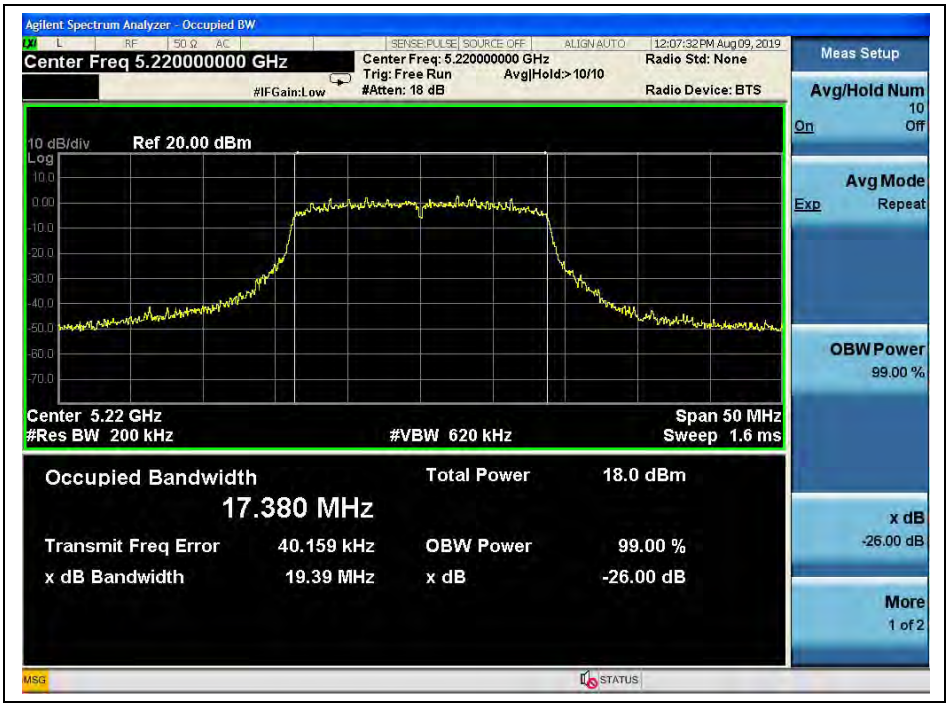
802.11ac (VHT20) Test mode

A. Test Verdict:

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
36	5180	19.60
44	5220	19.39
48	5240	19.39
Channel	**Frequency (MHz)**	**6dB Bandwidth (MHz)**
149	5745	15.13
157	5785	15.09
165	5825	15.06

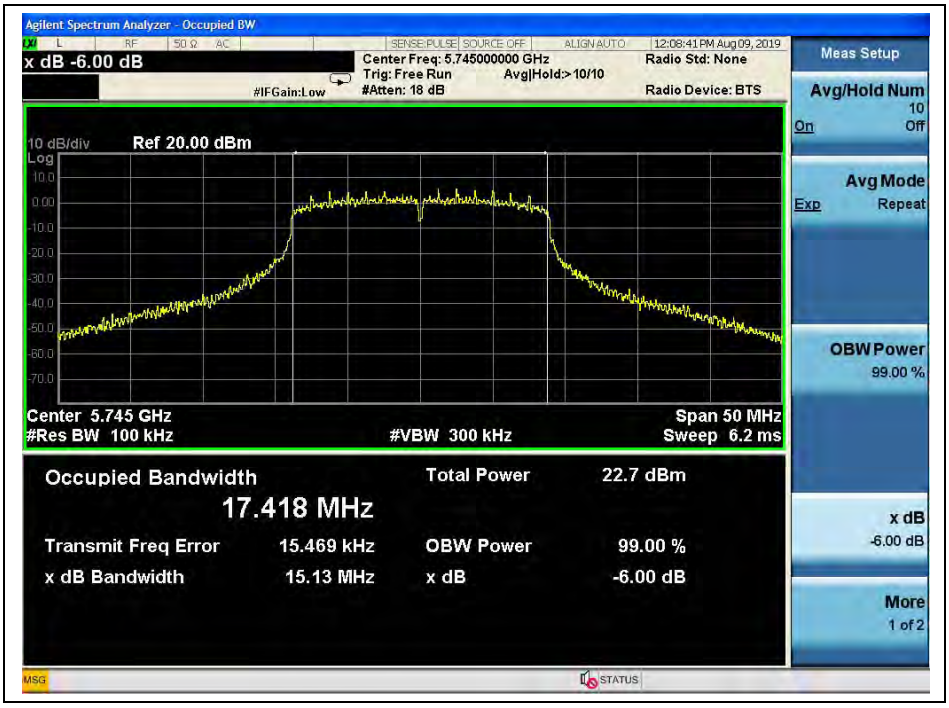
B. Test Plots

(Channel 36, 5180MHz, 802.11 ac (VHT20))



(Channel 44, 5220 MHz, 802.11 ac (VHT20))

(Channel 48, 5240MHz, 802.11 ac (VHT20))



(Channel 149, 5745MHz, 802.11 ac (VHT20))

(Channel 157, 5785MHz, 802.11 ac (VHT20))

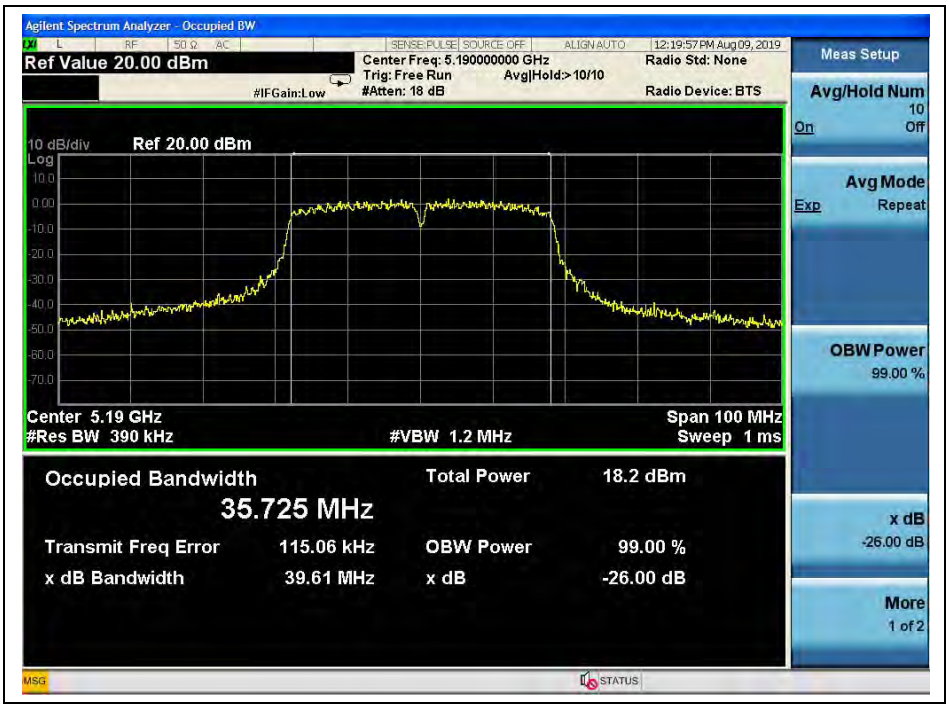
(Channel 165, 5825MHz, 802.11 ac (VHT20))

802.11 ac (VHT40) Test mode

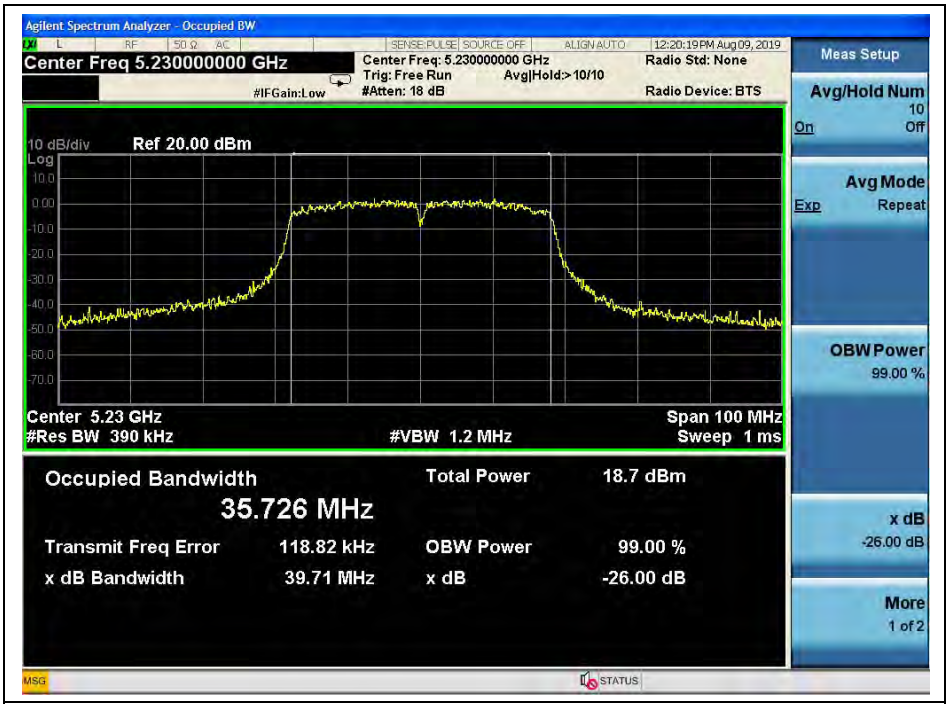
A. Test Verdict:

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
38	5190	39.61
46	5230	39.71
Channel	**Frequency (MHz)**	**6dB Bandwidth (MHz)**
151	5755	35.12
159	5795	33.85

B. Test Plots

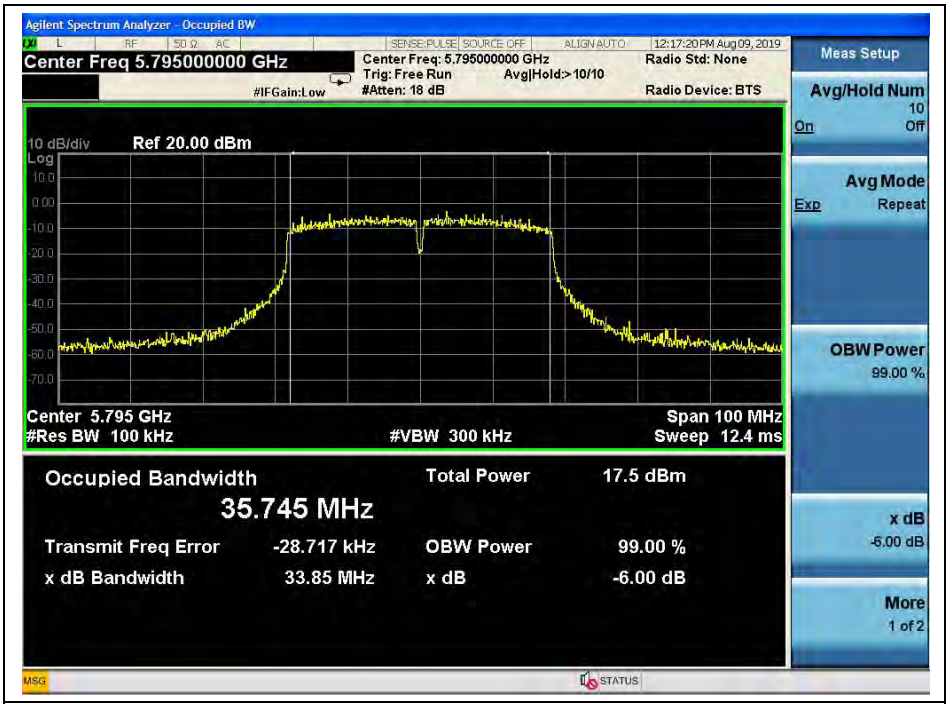


(Channel 38, 5190MHz, 802.11 ac (VHT40))



(Channel 46, 5230 MHz, 802.11 ac (VHT40))

(Channel 151, 5755 MHz, 802.11 ac (VHT40))



(Channel 159, 5795MHz, 802.11 ac (VHT40))

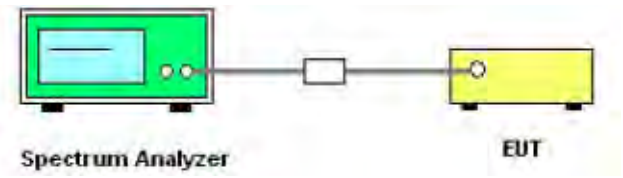
2.5. Maximum Power Spectral Density

2.5.1. Requirement

(1) For client devices in the 5.15-5.25 GHz band, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band.
(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band.
(3) For the band 5.725-5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500KHz band.
If transmitting antennas of directional gain greater than 6 dBi are used, the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
(4) According to KDB662911D01Measure-and-sum technique, the conducted emission level (e.g., transmit power or power in specified bandwidth) is measured at each antenna port. The measured results at the various antenna ports are then summed mathematically to determine the total emission level from the device. Summing is performed in units that are directly proportional to power.
(5) According to KDB 662911 D01, the directional gain = G_{ANT} +10log(N_{ANT}) dBi, where G_{ANT} is the antenna gain in dBi, N_{ANT} is the number of outputs.

2.5.2. Test Description

A. Test Set:



The EUT is coupled to the Spectrum Analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading.

B. Test Procedure

KDB 789033 Section F) Maximum Power Spectral Density (PSD) Method SA-3 was used in order to prove compliance

1) Set span to encompass the entire -26dB emission bandwidth
2) Set RBW = 1 MHz. Set VBW ≥ 3 MHz.
3) Number of points in sweep ≥ 2 Span / RBW. Sweep time = auto.
4) Detector = Average (RMS)
5) Trace mode=Max hold
6) Record the max value

2.5.3. Test Result

802.11a Test mode

A. Test Verdict:

Channel	Frequency (MHz)	Measured PPSD (dBm/MHz)		Limit (dBm/MHz)	Verdict
		ANT 0	ANT 1		
36	5180	3.06	2.78	11	PASS
44	5220	3.10	2.93		
48	5240	3.12	2.93		
Channel	Frequency (MHz)	Measured PPSD (dBm/500KHz)		Limit (dBm/500KHz)	Verdict
		ANT 0	ANT 1		
149	5745	-5.14	-5.58	30	PASS
157	5785	-5.01	-5.36		
165	5825	-4.70	-5.15		

B. Test Plots

(Channel 36, 5180MHz, 802.11a, ANT 0)

(Channel 44, 5220 MHz, 802.11a, ANT 0)

(Channel 48, 5240MHz, 802.11a, ANT 0)

(Channel 149, 5745MHz, 802.11a, ANT 0)

(Channel 157, 5785MHz, 802.11a, ANT 0)

(Channel 165, 5825MHz, 802.11a, ANT 0)

(Channel 36, 5180MHz, 802.11a, ANT 1)

(Channel 44, 5220 MHz, 802.11a, ANT 1)

(Channel 48, 5240MHz, 802.11a, ANT 1)

(Channel 149, 5745MHz, 802.11a, ANT 1)

(Channel 157, 5785MHz, 802.11a, ANT 1)

(Channel 165, 5825MHz, 802.11a, ANT 1)

802.11n (HT20) Test mode

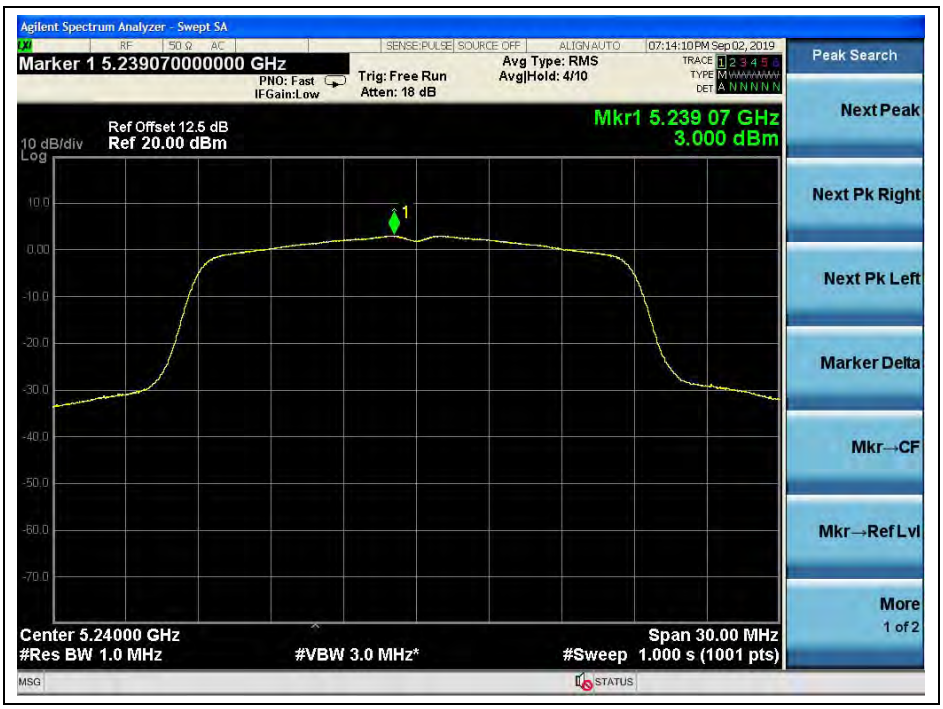
A. Test Verdict:

Channel	Frequency (MHz)	Measured PPSD (dBm/MHz)		Tatal PPSD (dBm/MHz)	Limit (dBm/MHz)	Verdict
		ANT 0	ANT 1			
36	5180	2.96	2.49	5.74	11	PASS
44	5220	3.16	2.52	5.86		
48	5240	3.00	2.56	5.79		
Channel	Frequency (MHz)	Measured PPSD (dBm/500KHz)		Tatal PPSD (dBm/500KHz)	Limit (dBm/500KHz)	Verdict
		ANT 0	ANT 1			
149	5745	-5.59	-6.03	-2.79	30	PASS
157	5785	-5.25	-5.88	-2.54		
165	5825	-5.21	-5.57	-2.38		
Note: Directional gain = -2.0dBi +10log(2) = 1.01dBi＜6dBi, so the limit shall be 11 dBm/MHz for 5.18-5.24 GHz band and 30 dBm/500KHz for 5.745-5.825 GHz band.						

B. Test Plots

(Channel 36, 5180MHz, 802.11 n (HT20), ANT0)

(Channel 44, 5220 MHz, 802.11 n (HT20), ANT0)



(Channel 48, 5240MHz, 802.11 n (HT20), ANT0)

(Channel 149, 5745MHz, 802.11 n (HT20), ANT0)

(Channel 157, 5785MHz, 802.11 n (HT20), ANT0)

(Channel 165, 5825MHz, 802.11 n (HT20), ANT0)

(Channel 36, 5180MHz, 802.11 n (HT20), ANT1)

(Channel 44, 5220 MHz, 802.11 n (HT20), ANT1)

(Channel 48, 5240MHz, 802.11 n (HT20), ANT1)

(Channel 149, 5745MHz, 802.11 n (HT20), ANT1)

(Channel 157, 5785MHz, 802.11 n (HT20), ANT1)

(Channel 165, 5825MHz, 802.11 n (HT20), ANT1)

802.11n (HT40) Test mode

A. Test Verdict:

Channel	Frequency (MHz)	Measured PPSD (dBm/MHz)		Tatal PPSD (dBm/MHz)	Limit (dBm/MHz)	Verdict
		ANT 0	ANT 1			
38	5190	0.07	-0.32	2.89	11	PASS
46	5230	0.09	-0.34	2.89		
Channel	Frequency (MHz)	Measured PPSD (dBm/500KHz)		Tatal PPSD (dBm/500KHz)	Limit (dBm/500KHz)	Verdict
		ANT 0	ANT 1			
151	5755	-8.28	-8.84	-5.54	30	PASS
159	5795	-8.20	-8.58	-5.37		
Note: Directional gain = -2.0dBi +10log(2) = 1.01dBi＜6dBi, so the limit shall be 11 dBm/MHz for 5.18-5.24 GHz band and 30 dBm/500KHz for 5.745-5.825 GHz band.						

B. Test Plots

(Channel 38, 5190MHz, 802.11n (HT40), ANT0)

(Channel 46, 5230 MHz, 802.11n (HT40), ANT0)

(Channel 151, 5755 MHz, 802.11n (HT40), ANT0)

(Channel 159, 5795MHz, 802.11n (HT40), ANT0)

(Channel 38, 5190MHz, 802.11n (HT40), ANT1)

(Channel 46, 5230 MHz, 802.11n (HT40), ANT1)

(Channel 151, 5755 MHz, 802.11n (HT40), ANT1)

(Channel 159, 5795MHz, 802.11n (HT40), ANT1)

802.11 ac (VHT20) Test mode

A. Test Verdict:

Channel	Frequency (MHz)	Measured PPSD (dBm/MHz)		Tatal PPSD (dBm/MHz)	Limit (dBm/MHz)	Verdict
		ANT 0	ANT 1			
36	5180	2.92	2.45	5.70	11	PASS
44	5220	3.10	2.54	**5.84**		
48	5240	2.99	2.56	5.79		
Channel	Frequency (MHz)	Measured PPSD (dBm/500KHz)		Tatal PPSD (dBm/500KHz)	Limit (dBm/500KHz)	Verdict
		ANT 0	ANT 1			
149	5745	-5.51	-5.93	-2.70	30	PASS
157	5785	-5.41	-5.84	-2.61		
165	5825	-5.11	-5.21	-2.15		
Note: Directional gain = -2.0dBi +10log(2) = 1.01dBi＜6dBi, so the limit shall be 11 dBm/MHz for 5.18-5.24 GHz band and 30 dBm/500KHz for 5.745-5.825 GHz band.						

B. Test Plots

(Channel 36, 5180MHz, 802.11 ac (VHT20), ANT0)

(Channel 44, 5220 MHz, 802.11 ac (VHT20), ANT0)

(Channel 48, 5240MHz, 802.11 ac (VHT20), ANT0)

(Channel 149, 5745MHz, 802.11 ac (VHT20), ANT0)

(Channel 157, 5785MHz, 802.11 ac (VHT20), ANT0)

(Channel 165, 5825MHz, 802.11 ac (VHT20), ANT0)

(Channel 36, 5180MHz, 802.11 ac (VHT20), ANT1)

(Channel 44, 5220 MHz, 802.11 ac (VHT20), ANT1)

(Channel 48, 5240MHz, 802.11 ac (VHT20), ANT1)

(Channel 149, 5745MHz, 802.11 ac (VHT20), ANT1)

(Channel 157, 5785MHz, 802.11 ac (VHT20), ANT1)

(Channel 165, 5825MHz, 802.11 ac (VHT20), ANT1)

802.11 ac (VHT40) Test mode

A. Test Verdict:

Channel	Frequency (MHz)	Measured PPSD (dBm/MHz)		Tatal PPSD (dBm/MHz)	Limit (dBm/MHz)	Verdict
		ANT 0	ANT 1			
38	5190	0.10	-0.35	2.89	11	PASS
46	5230	0.04	-0.40	2.83		
Channel	Frequency (MHz)	Measured PPSD (dBm/500KHz)		Tatal PPSD (dBm/500KHz)	Limit (dBm/500KHz)	Verdict
		ANT 0	ANT 1			
151	5755	-8.24	-8.85	-5.52	30	PASS
159	5795	-8.20	-8.48	-5.33		
Note: Directional gain = -2.0dBi +10log(2) = 1.01dBi＜6dBi, so the limit shall be 11 dBm/MHz for 5.18-5.24 GHz band and 30 dBm/500KHz for 5.745-5.825 GHz band.						

B. Test Plots

(Channel 38, 5190MHz, 802.11 ac (VHT40), ANT0)

(Channel 46, 5230 MHz, 802.11 ac (VHT40), ANT0)

(Channel 151, 5755 MHz, 802.11 ac (VHT40), ANT0)

(Channel 159, 5795MHz, 802.11 ac (VHT40), ANT0)

(Channel 38, 5190MHz, 802.11 ac (VHT40), ANT1)

(Channel 46, 5230 MHz, 802.11 ac (VHT40), ANT1)

(Channel 151, 5755 MHz, 802.11 ac (VHT40), ANT1)

(Channel 159, 5795MHz, 802.11ac (VHT40), ANT1)

2.6. Frequency Stability

2.6.1. Requirement

Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

2.6.2. Test Procedure

The EUT was placed inside of an environmental chamber as the temperature in the chamber was varied between 5°C to 40°C. The temperature was incremented by 10° intervals and the unit was allowed to stabilize at each temperature before each measurement. The center frequency of the transmitting channel was evaluated at each temperature and the frequency deviation from the channel's center frequency was recorded. Data for the worst case channel is shown below.

2.6.3. Test Result

U-NII-1 (Ch. 36) 5180MHz				
VOLTAGE (%)	POWER (VDC)	TEMP (°C)	Freq Dev. (Hz)	Deviation (ppm)
100%	3.85	+20(Ref)	45	0.009
100%		-30	21	0.004
100%		-20	38	0.007
100%		-10	50	0.010
100%		0	26	0.005
100%		+10	17	0.003
100%		+20	20	0.004
100%		+30	38	0.007
100%		+40	29	0.006
100%		+50	43	0.008
85%	3.27	+20	48	0.009
115%	4.43	+20	42	0.008

U-NII-3 (Ch. 149) 5745MHz				
VOLTAGE (%)	POWER (VDC)	TEMP (°C)	Freq Dev. (Hz)	Deviation (ppm)
100%	3.85	+20(Ref)	22	0.004
100%		-30	32	0.006
100%		-20	23	0.004
100%		-10	18	0.003
100%		0	34	0.006
100%		+10	41	0.007
100%		+20	21	0.004
100%		+30	49	0.009
100%		+40	51	0.009
100%		+50	24	0.004
85%	3.27	+20	41	0.007
115%	4.43	+20	34	0.006

2.7. Conducted Emission

2.7.1. Requirement

According to FCC section 15.207, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150kHz to 30MHz shall not exceed the limits in the following table, as measured using a 50μH/50Ω line impedance stabilization network (LISN).

Frequency range (MHz)	Conducted Limit (dBμV)	
	Quai-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
5 - 30	60	50

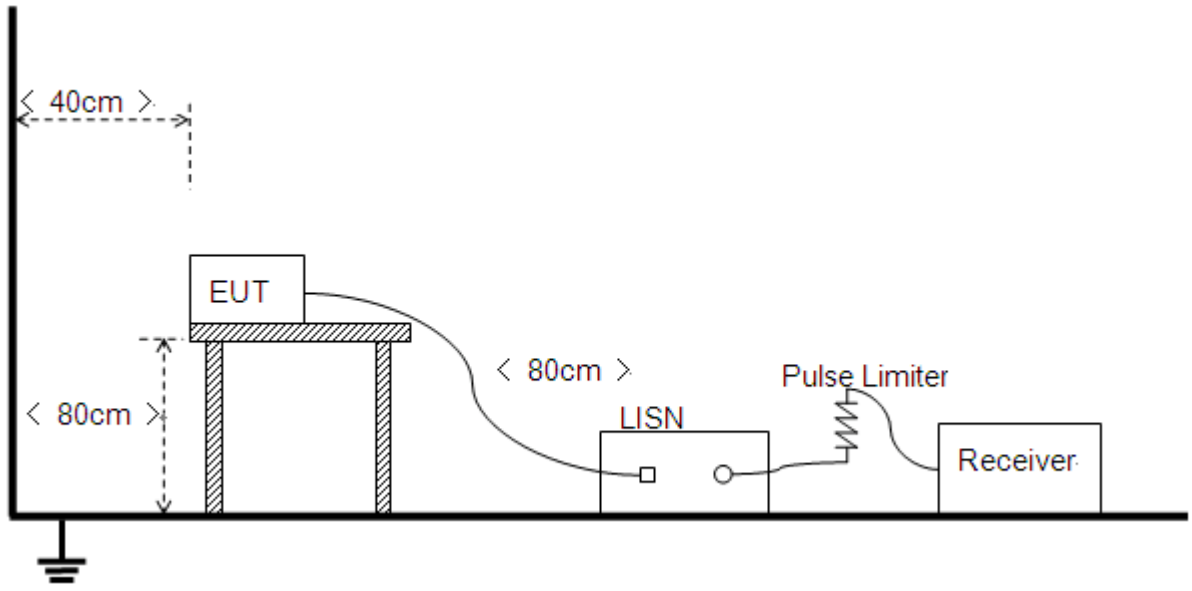
NOTE:

(a) The lower limit shall apply at the band edges.

(b) The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50MHz.

2.7.2. Test Description

A. Test Setup:



The Table-top EUT was placed upon a non-metallic table 0.8m above the horizontal metal reference ground plane. EUT was connected to LISN and LISN was connected to reference Ground Plane. EUT was 80cm from LISN. The set-up and test methods were according to ANSI C63.10: 2013.

2.7.3. Test Result

The maximum conducted interference is searched using Peak (PK), if the emission levels more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT are performed. Refer to recorded points and plots below.

Note: Both of the test voltage AC 120V/60Hz and AC 230V/50Hz were considered and tested respectively, only the results of the worst case AC 120V/60Hz were recorded in this report.

A. Test setup:

Test Mode: EUT+ ADAPTOR + WIFI TX

Test Voltage: AC 120V/60Hz

The measurement results are obtained as below:

$E\ [dB\mu V] = U_R + L_{Cable\ loss}\ [dB] + A_{Factor}$

U_R: Receiver Reading

A_{Factor}: Voltage division factor of LISN